ANL/CFCT-C2019-19010

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Small-Scale Recycling of Irradiated Uranium and Transuranic Elements (Np, Pu) Using 3D-Printed Centrifugal Contactors

Final CRADA Report

Chemical and Fuel Cycle Technologies

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Final CRADA Report

prepared by
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Participants: Niowave, Inc., University of Nevada Las Vegas (UNLV)

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Non Proprietary

Final CRADA Report

For the Office of Scientific and Technical Information (OSTI)

CRADA Number: 2019-19010
CRADA Title: Small-Scale Recycling of Irradiated Uranium and Transuranic Elements (Np, Pu) Using 3D-Printed Centrifugal Contactors.
CRADA Start Date 10/1/2018 – **End Date** 1/20/2020

DOE Program or Other Government Support
Program office: Office of Nuclear Energy
Program manager name: Hemant Bhimnathwala
Program manager phone or email: hbhimnathwala@anl.gov

Participant(s)

Participant 1 name: Niowave, Inc.
Complete address: 1012 N Walnut Ave. Lansing, MI 48906

Participant 2 name: University of Nevada Las Vegas
Complete address: 4505 S Maryland Parkway, Las Vegas, NV 89154

Participant 3 name: Click or tap here to enter text.
Complete address: Click or tap here to enter text.

Argonne National Laboratory

Argonne PI(s): Michael Alex Brown

Funding Table

To add rows, right-click in bottom row and select “Insert” “rows above”.

	Planned Funding	Actual Funding	In-Kind
Government	$425,000	$425,000	
Niowave, Inc.	$502,222	$502,222	$325,000*
UNLV	$75,000	$75,000	$
Enter Participant 3 here	$	$	$
Total	**$1,002,222**	**$1,002,222**	**$325,000**

* The project was scheduled to end in Dec 2020 but was terminated on Jan 21, 2020. Approximately $100k was allocated for laboratory carryover in FY20. This amount reflects the total costed by both parties.

Nature of Work

Describe the research (summary of Scope of Work and principal objectives of the CRADA):

Niowave’s technology employs super-conducting linear accelerators to induce fission on low-enriched uranium targets followed by subsequent radiochemical processing to purify ^{99}Mo as well as a number of other fission products. Argonne’s Radiochemistry group (CFCT), in partnership with Niowave and UNLV, will be managing the TCF project to develop a closed-cycle loop for Niowave’s uranium targets. The roles of the DOE national laboratory partner will be to 1) develop a basic chemical understanding of the separations and purifications required to meet industry standards, 2) initiate the additive manufacturing (AM) of the centrifugal contactors, 3) develop a process flowsheet using Argonne computer codes.

DOE mission area(s):
Energy and Environmental Science and Technology
National Security
Choose an item.

Conclusions drawn from this CRADA; include any major accomplishments:
Argonne, Niowave, and UNLV performed an exhaustive investigation of Niowave's proposed chemical process that was designed to treat and recover their valuable target material for medical isotope production. A number of results and conclusions were derived from this study. First, it was demonstrated that 3D-printed materials (centrifugal contactors) are capable of treating and recovering uranium solutions. Nearly one dozen experiments were conducted at Niowave using natural uranium and recoveries varied between 90-100% with 3D printed prototypes. Multi-stage 3D printed contactor modules were developed to minimize the footprint and improve reliability performance. Second, using Argonne chemical modelling resources, optimized flowsheets were developed to fully purify and recover uranium from the majority of fission fragments. These flowsheets were experimentally validated. Overall, the successful collaboration with Argonne increased the momentum of Niowave's technology, expertise, and mission of producing medical isotopes without highly enriched uranium.

Technology Transfer-Intellectual Property
Argonne National Laboratory background IP:
CONFIRMATION OF TEMPORARY, ROYALTY-FREE GOVERNMENT USE LICENSE OF US PATENT 10,221,466 (IN-15-019) - Molybdenum recovery from aqueous nitric acid solution by solvent extraction

Participant(s) background IP:
Argonne, Niowave, Inc.

Identify any new Subject Inventions as a result of this CRADA:
Click or tap here to enter text.

Summary of technology transfer benefits to industry and, if applicable, path forward/anticipated next steps towards commercialization:
Niowave requested a government use license of the IP (10,221,466 – IN-15-019). This technology would help Niowave expedite the purification and distribution of high-priority medical isotopes.

Other information/results (papers, inventions, software, etc.):
Manuscript in preparation: Superconducting electron accelerator production and purification of Mo99.

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